WHAT IS CLAIMED IS:

1. A corrosion resistant, high strength austenitic stainless steel consisting of 1.0% or less of Si, 2.0% or less of Mn, 0.5% or less of O, 7 to 30% of Ni, 14 to 26% of Cr, 0.3% or less of combination of C and N, at least one element selected from the group consisting of 1.0% or less of Ti, 2.0% or less of Zr and 2.0% or less of Nb, and the balance consisting of Fe and unavoidable impurities, the percentage being given in weight basis;

said steel containing carbonitride with a grain size of several to 100 nm dispersed therein;

said steel having an average crystal grain size of 1 μm or less; and

said steel containing 90% by volume or more of austenite phase.

2. A corrosion resistant, high strength austenitic stainless steel consisting of 1.0% or less of Si, 2.0% or less of Mn, 0.5% or less of O, 7 to 30% of Ni, 14 to 26% of Cr, 3% or less of Mo, 0.3% or less of combination of C and N, at least one element selected from the group consisting of 1.0% or less of Ti, 2.0% or less of Zr and 2.0% or less of Nb, and the balance consisting of Fe and unavoidable impurities, the percentage being given in weight basis;

said steel containing carbonitride with a grain size of several to 100 nm dispersed therein;

said steel having an average crystal grain size of 1 μm

or less; and

said steel containing 90% by volume or more of austenite phase.

3. A corrosion resistant, high strength austenitic stainless steel according to Claim 1 or 2, wherein the combination of C and N is contained in an amount of from 0.1 to 0.3% by weight.

4. A method for manufacturing a corrosion resistant, high strength austenitic stainless steel, which comprises the steps of:

providing a mechanically milled powder with an average crystal grain size of 200 nm or less consisting of 1.0% or less of Si, 2.0% or less of Mn, 0.5% or less of O, 7 to 30% of Ni, 14 to 26% of Cr, 0.3% or less of combination of C and N, at least one element selected from the group consisting of 1.0% or less of Ti, 2.0% or less of Zr and 2.0% or less of Nb, and the balance consisting of Fe and unavoidable impurities, the percentage being given in weight basis; and

subjecting said mechanically processed powder to a process selected from the group consisting of:

(a) consolidating the mechanically milled powder at 700 to 900°C, and

(b) consolidating the mechanically milled powder at 700 to 900°C to obtain a consolidated material and thermomechanically treating the consolidated material.

5. A method for manufacturing a corrosion resistant, high strength austenitic stainless steel,

which comprises the steps of:

providing a mechanically milled powder with an average crystal grain size of 200 nm or less consisting of 1.0% or less of Si, 2.0% or less of Mn, 0.5% or less of O, 7 to 30% of Ni, 14 to 26% of Cr, 3% or less of Mo, 0.3% or less of combination of C and N, at least one element selected from the group consisting of 1.0% or less of Ti, 2.0% or less of Zr and 2.0% or less of Nb, and the balance consisting of Fe and unavoidable impurities, the percentage being given in weight basis; and subjecting said mechanically milled powder to a process selected from the group consisting of:

(a) consolidating the mechanically milled powder at 700 to 900°C, and

(b) consolidating the mechanically milled powder at 700 to 900°C to obtain a consolidated material and thermomechanically treating the consolidated material.

6. The method according to Claim 4 or 5, wherein the value f determined by the following equation (1) falls within the range of from 0.4 to 2.0:

$$f = [8.33(C) + 7.14(N)]/[1.10(Zr) + 2.09(Ti) + 1.08(Nb)] \quad (1)$$

wherein (C), (N), (Ti), (Zr) and (Nb) are the amounts (weights) of the C, N, Ti, Zr and Nb, respectively, in the mechanically processed powder.

7. The method according to Claim 4 or 5, wherein the mechanically processed powder is a product obtained by subjecting a pre-alloy powder or a powder that meets

the composition defined in Claim 4 or 5 as a whole to mechanical grinding or alloying treatment with an attrition mill or ball mill at 100°C or lower for 30 hours or more so that the product has an average crystal grain size of 200 nm or less.

8. The method according to Claim 7, wherein said mechanical grinding or alloying treatment is conducted using steel balls made of an Fe alloy containing 0.3% or less of combination of C and N and having a heat conductivity at 100°C of 16.7 W/m·K or higher.

9. The method according to Claim 4 or 5, wherein said consolidating are carried out at 700 to 900°C after the mechanically processed powder has been retained at a temperature within a range of from 400 to 650°C for a period of 0.5 to 6 hours, or alternatively, after the mechanically processed powder has been suffered from a rise of temperature from 400 to 650°C for a period of 0.5 to 6 hours.

10. The method according to Claim 4 or 5, wherein the step of consolidating and the step of successive thermomechanical treatment of the molded product include the step of solidifying the mechanically processed powder by hot compression, hot rolling, hot isostatic pressing or hot extrusion at 700 to 900°C, or the step of subjecting the molded product to a heat treatment or hot forging at 700 to 900°C, and the additional step of imparting a desired shape to the molded product during any of these preceding steps.

11. A method for manufacturing a corrosion resistant, high strength austenitic stainless steel, which comprises the step of subjecting the corrosion resistant, high strength austenitic stainless steel according to Claim 1 or 2 to press molding at a temperature of 700 to 900°C to give the steel a desired shape.

12. The method according to any one of Claims 1-3, wherein the value f determined by the following equation (1) falls within the range of from 0.4 to 2.0:

$$f = [8.33(C) + 7.14(N)]/[1.10(Zr) + 2.09(Ti) + 1.08(Nb)] \quad (1)$$

wherein (C), (N), (Ti), (Zr) and (Nb) are the amounts (weights) of the C, N, Ti, Zr and Nb, respectively, in the mechanically processed powder.